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"Formulation and Evaluation of a Fruit Extract-Based Anti-Acne Cream: A Novel Approach Using Natural Ingredients"

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ABSTRACT

The increasing demand for natural, safe, and effective dermatological treatments has driven the exploration of plant-based formulations for acne management. In this study, an anti-acne cream was formulated using fruit-based extracts and evaluated for its physicochemical and therapeutic properties. Fruit extracts from papaya, orange peel, green tea, and lemon were prepared using the maceration method with 70% ethanol as a solvent. A water-in-oil (W/O) emulsion cream base was developed comprising beeswax, stearic acid, almond oil, jojoba oil, emulsifying wax, distilled water, glycerin, and aloe vera gel. The oil and aqueous phases were separately heated to 70°C, emulsified under high-shear mixing, followed by the incorporation of concentrated fruit extracts and a preservative during the cooling phase. The final formulation underwent comprehensive evaluation, including pH measurement, viscosity determination, spreadability assessment, stability studies at 4°C, 25°C, and 40°C over four weeks, microbial contamination analysis, and efficacy testing on volunteers presenting mild to moderate acne. The cream demonstrated favorable pH (5.4), optimal viscosity and spreadability, excellent stability across varied storage conditions, absence of microbial contamination, and a significant reduction in acne lesions without inducing skin irritation. These findings support the potential of fruit extract-based topical formulations as safe and effective alternatives to conventional chemical anti-acne therapies.

Keywords :- Anti-Acne Cream, Fruit Extracts, Natural Ingredients, Water-in-Oil Emulsion, pH, Stability, Microbial Analysis.

INTRODUCTION

Acne vulgaris is a chronic, multifactorial inflammatory disease of the pilosebaceous unit, predominantly affecting adolescents and young adults. It is characterized by the formation of comedones, papules, pustules, nodules, and in some cases, cystic lesions that can lead to permanent scarring and psychological distress **[1].** Several factors contribute to acne development, including excess sebum production, abnormal keratinization, colonization by Cutibacterium acnes, and inflammatory responses **[2].**

Although numerous chemical-based topical and systemic therapies, such as benzoyl peroxide, retinoids, and antibiotics, are widely used for acne management, they often present significant drawbacks, including skin irritation, dryness, antibiotic resistance, and long-term toxicity **[3][4].** These limitations have triggered growing interest in the exploration of safer, natural alternatives with fewer side effects.

Natural remedies, particularly those derived from plant-based sources, have shown promising therapeutic potential due to their biocompatibility, antioxidant activity, anti-inflammatory properties, and antimicrobial effects **[5].** Among them, fruit extracts offer an abundant source of bioactive phytochemicals such as flavonoids, phenolic acids, vitamins, and enzymes, which can effectively target multiple pathways involved in acne pathogenesis.

In this context, specific fruit extracts have attracted considerable attention. Papaya (Carica papaya) is rich in papain, an enzymatic agent that promotes skin exfoliation and exhibits anti-inflammatory effects **[6].** Orange peel (Citrus sinensis) contains high levels of vitamin C and flavonoids that contribute to its antibacterial and astringent properties, helping to reduce sebum production and bacterial colonization **[7].** Lemon (Citrus limon) extract provides natural bleaching agents and antioxidants that aid in skin lightening and reducing post-inflammatory hyperpigmentation **[8].** Green tea (Camellia sinensis) extract is particularly valuable for its polyphenolic catechins, notably epigallocatechin gallate (EGCG), which demonstrate strong antimicrobial, anti-inflammatory, and sebum-suppressing activities **[9].**

Given the potential of these bioactive fruit extracts, the objective of the present research was to develop and evaluate a fruit extract-enriched water-in-oil (W/O) anti-acne cream as a natural, safe, and sustainable therapeutic alternative to conventional chemical-based treatments. The study involved the preparation of extracts through the maceration technique, formulation of a W/O emulsion-based cream using a structured oil and aqueous phase system, and comprehensive evaluation of the final product for physicochemical properties, stability, microbiological safety, and therapeutic efficacy in managing mild to moderate acne conditions.

MATERIAL AND METHODS FOR ANTI-ACNE CREAM FORMULATION

1. **Materials :**
   All ingredients used in the formulation were of pharmaceutical or cosmetic grade and were procured from certified suppliers. Analytical grade ethanol (70%) and distilled water were used for extraction and formulation purposes. The detailed composition of the cream base and fruit extracts is provided below:

Table 1: Composition of Cream Base (60g total)

Phase	Ingredient	Quantity (g)	Function
Oil Phase	Beeswax	5	Structure and consistency **[10]**
	Stearic Acid	3	Thickener and stabilizer**[11]**
	Almond Oil	5	Emollient, non-comedogenic**[12]**
	Jojoba Oil	5	Sebum regulator**[13]**
	Emulsifying Wax	4	Emulsification agent**[14]**
Aqueous Phase	Distilled Water	30	Solvent**[15]**
	Glycerin	3	Humectant**[16]**
	Aloe Vera Gel	2	Skin soothing and hydrating**[17]**

- **Photos of Materials used for cream based as per above mentioned table :-**

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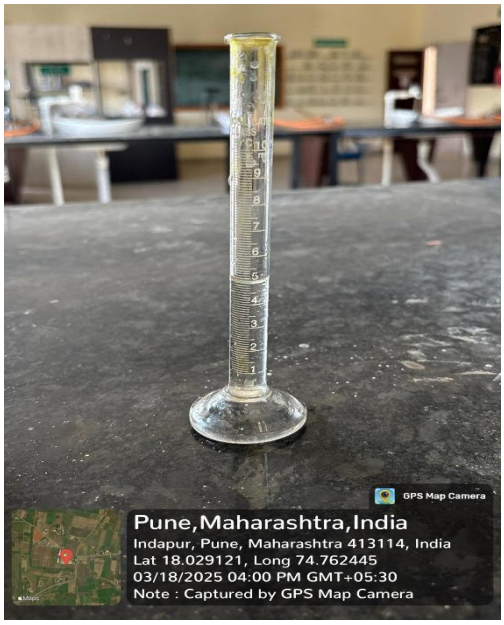
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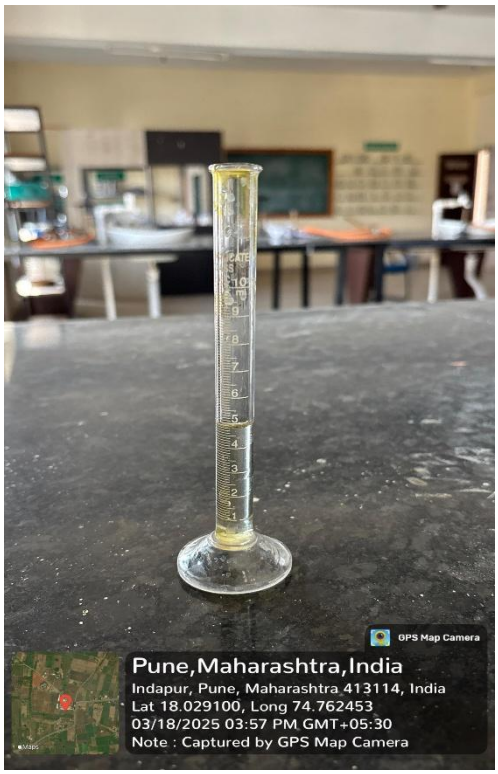
(**Fig No-1&2 :** Bees wax and Jojoba Oil)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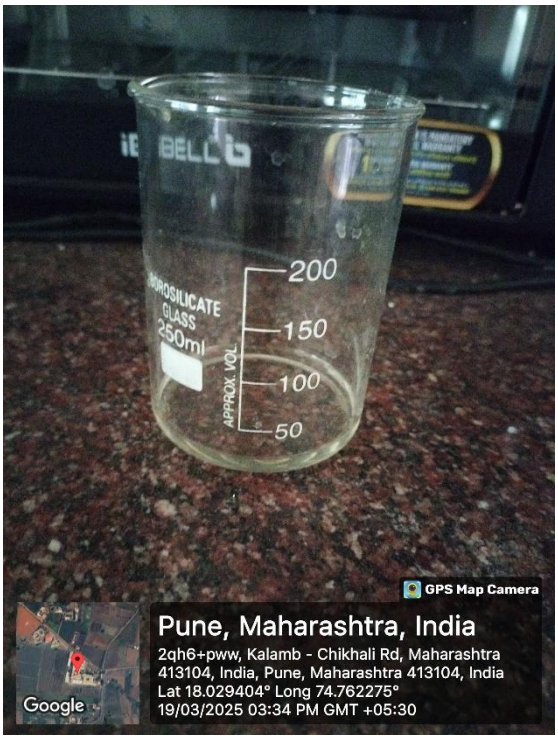
(**Fig No- 3 & 4 :** Almond oil and Steric acid)



(**Fig No – 5 & 6 :** Emulsifying wax and Glycerin)

2. Phytochemical Profile and Therapeutic Role of Fruit-Based Active Ingredients in a Natural Anti-Acne Cream :

i. Papaya Extract :

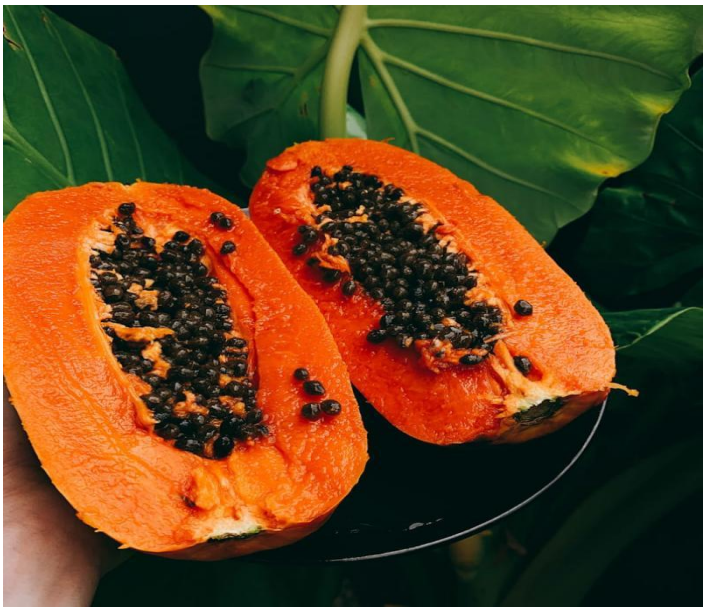
- Botanical Name: Carica papaya
- Source: Fresh ripe papaya fruit pulp.

- **Extraction Method :**
- Maceration or blending of fresh pulp followed by filtration.
- Sometimes ethanol is used to obtain ethanolic extract of papaya.

- **Active Compounds :**
- Papain – proteolytic enzyme that breaks down proteins
- Vitamin A (retinol) – boosts skin cell turnover
- Vitamin C – antioxidant, promotes collagen and brightens skin
- Flavonoids – antioxidant and antibacterial

- **Mechanism of Action :**
- Papain gently digests and removes dead skin cells (keratolytic action)
- Opens clogged pores and reduces formation of comedones
- Reduces acne inflammation and soothes redness
- Antibacterial activity against Propionibacterium acnes

- **Benefits for Acne-Prone Skin:**
- Clears acne lesions by exfoliating dead cells
- Prevents new acne by unclogging pores
- Improves overall skin texture
- Fades mild acne scars over time **[18, 19].**



(**Fig No 7 :** Fresh Papaya)

ii. Orange Peel Extract :

- **Botanical Name:** Citrus sinensis
- **Source:** Sun-dried orange peels, ground to powder form.

- **Extraction Method:**
  - Ethanolic extraction or aqueous decoction from peel powder.
  - Can also use cold maceration with ethanol or hot water extraction.

- **Active Compounds:**
  - Vitamin C (ascorbic acid) – antioxidant and brightening agent
  - Hesperidin – anti-inflammatory and antibacterial flavonoid
  - Limonene – natural astringent and oil control agent
  - Tannins – pore tightening and antimicrobial

- **Mechanism of Action:**
  - Acts as a natural astringent, shrinking pores and controlling sebum
  - Reduces oxidative stress in acne lesions via antioxidants
  - Antibacterial properties against skin pathogens

- **Benefits for Acne-Prone Skin:**
  - Controls oily skin and reduces acne severity
  - Brightens and evens skin tone
  - Mild antibacterial and antioxidant activity **[20,21]**

(**Fig No – 8 :** Fresh Orange and Orange peel)

iii. Green Tea Extract

- **Botanical Name:** Camellia sinensis
- **Source:**Green tea leaves (fresh or dried)

- **Extraction Method:**
  - Aqueous extraction via boiling or ethanolic extraction of crushed leaves.

- **Active Compounds:**
  - EGCG (Epigallocatechin gallate) – potent antioxidant and anti-inflammatory
  - Catechins – antimicrobial and antioxidant
  - Tannins – pore tightening, oil control

- **Mechanism of Action:**
  - Inhibits activity of Cutibacterium acnes
  - Regulates sebum production by reducing androgen effect on sebaceous glands

- Calms irritated and inflamed skin lesions

- **Benefits for Acne-Prone Skin:**
- Reduces acne-related swelling, redness, and irritation
- Prevents new breakouts by controlling oil
- Repairs and strengthens skin barrier **[22, 23].**

(**Fig No – 9 :** Fresh Green Tea)

iv. Lemon Extract :
- **Botanical Name:** Citrus limon
- **Source:** Fresh lemon juice or peel extract

- **Extraction Method:**
- Cold pressing juice from fresh lemon.
- Alternatively, hydroalcoholic extraction from lemon peels.

- **Active Compounds:**
- Citric acid – exfoliates dead skin layers (AHA action)
- Vitamin C – antioxidant, improves pigmentation
- Flavonoids – antimicrobial, brightening agent
- Limonene – skin purifying and astringent

- **Mechanism of Action:**
- Chemical exfoliation unclogs pores and clears debris
- Reduces pigmentation from acne scars
- Pore-tightening and antibacterial activity
- Benefits for Acne-Prone Skin:
- Fades dark spots and scars
- Controls excess oil production
- Prevents future breakouts via pore tightening **[24, 25]**

Fig No – 10 : Fresh Lemon Fruit]

3. Preparation of Fruit Extracts

The following fruit-based extracts were prepared using the maceration method **[26]** :

Table 2: Preparation of Fruit Extracts

Extract	Raw Material	Solvent Used	Maceration Time	Concentration Method
Papaya Extract	Fresh Papaya Pulp	Ethanol 70%	48 hours	Filtration + Rotary Evaporation
Orange Peel Extract	Dried Orange Peel Powder	Ethanol 70%	48 hours	Filtration + Rotary Evaporation
Green Tea Extract	Green Tea Leaves	Ethanol 70%	24 hours	Filtration + Rotary Evaporation
Lemon Extract	Fresh Lemon Juice	Ethanol 70%	24 hours	Filtration + Rotary Evaporation

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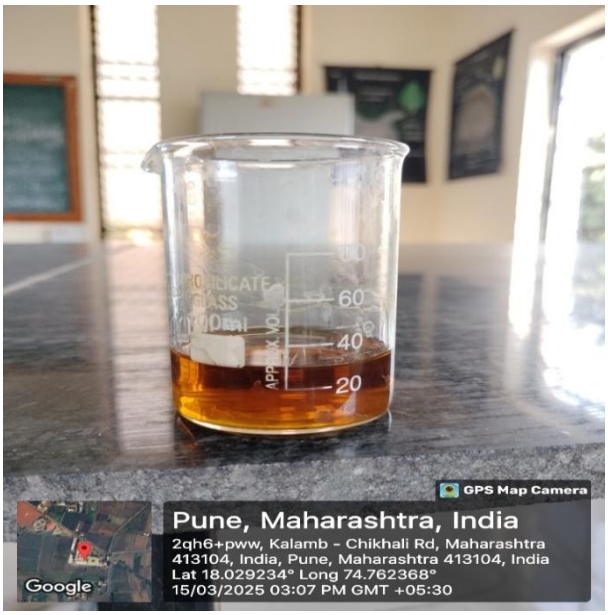
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(**Fig No 11 & 12 :** Papaya and Orange Extract)

(**Fig No 13** : Oil phase Preparation)

4. Formulation of Anti-Acne Cream

A Water-in-Oil (W/O) emulsion-based anti-acne cream was formulated using the following composition **[27]**

Table 3: Final Anti-Acne Cream Formulation

Phase	**Ingredients**	**% w/w**	**Function**
Oil Phase	Stearic Acid	10%	Thickening Agent **[11]**
	Cetyl Alcohol	2%	Co-emulsifier**[28]**
	Almond Oil	5%	Emollient **[12]**
	Shea Butter	3%	Hydrating Agent **[29]**
Aqueous Phase	Glycerin	4%	Humectant**[16]**
	Distilled Water	q.s. to 100%	Solvent**[15]**
Active Extracts	Papaya Extract	3 ml/g	Enzymatic exfoliation, antibacterial **[30]**
	Orange Peel Extract	3 ml/g	Astringent, antioxidant **[31]**
	Green Tea Extract	1 ml/g	Anti-inflammatory, antibacterial **[32]**
	Lemon Extract	1 ml/g	Astringent, skin brightening **[33]**
Preservative	Phenoxyethanol	0.5%	Preservative**[34]**

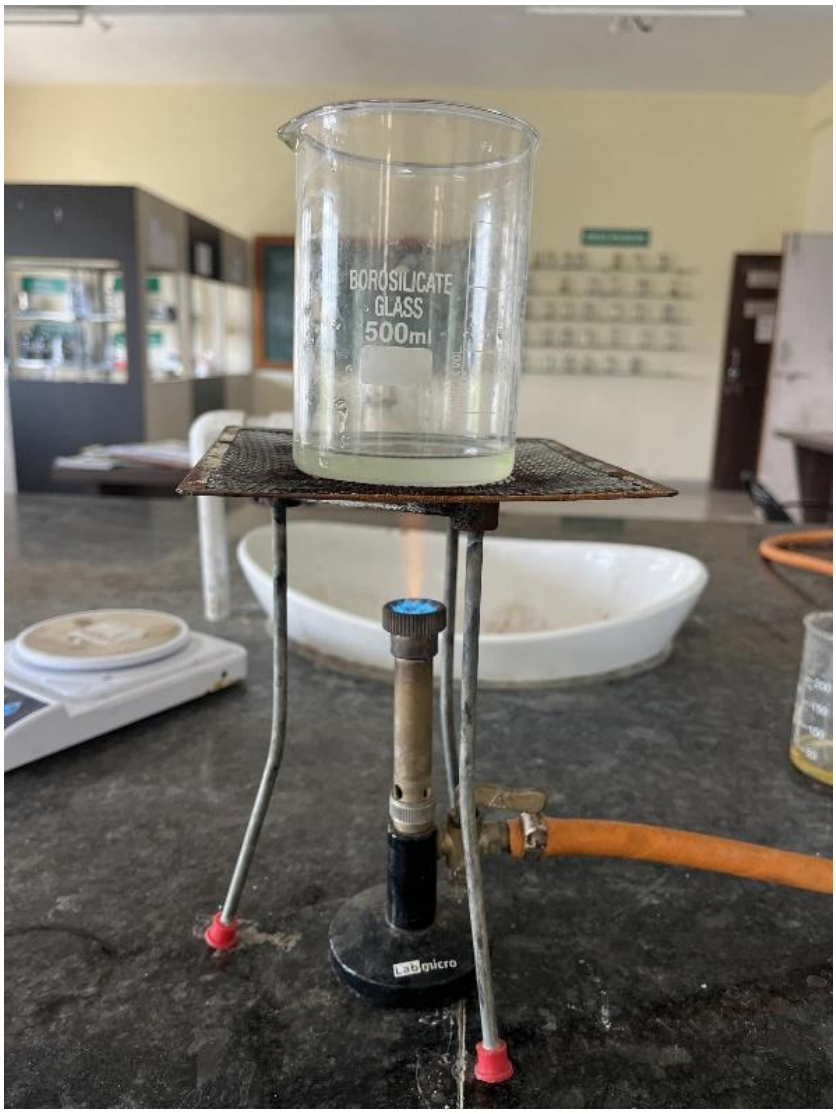
5. Preparation Process [35], [36]

5.1 Oil Phase Preparation:

All oil-phase ingredients including stearic acid (10%), cetyl alcohol (2%), almond oil (5%), and shea butter (3%) were accurately weighed using a digital balance. These components were placed in a clean, dry beaker and heated to 70°C using a thermostatically controlledwater bath. The heating process was done to melt and homogenize all lipid based ingredients completely, ensuring proper consistency and stability of the emulsion **[35].**

5.2 .Aqueous Phase Preparation:

In a separate beaker, the aqueous components — distilled water (q.s. to 100%) and glycerin (4%) — were mixed and similarly heated to 70°C. Maintaining the same temperature for both phases helps prevent premature separation and ensures smooth emulsification**[35].**



(**Fig No 14 :** Aqueous phase Preparation)

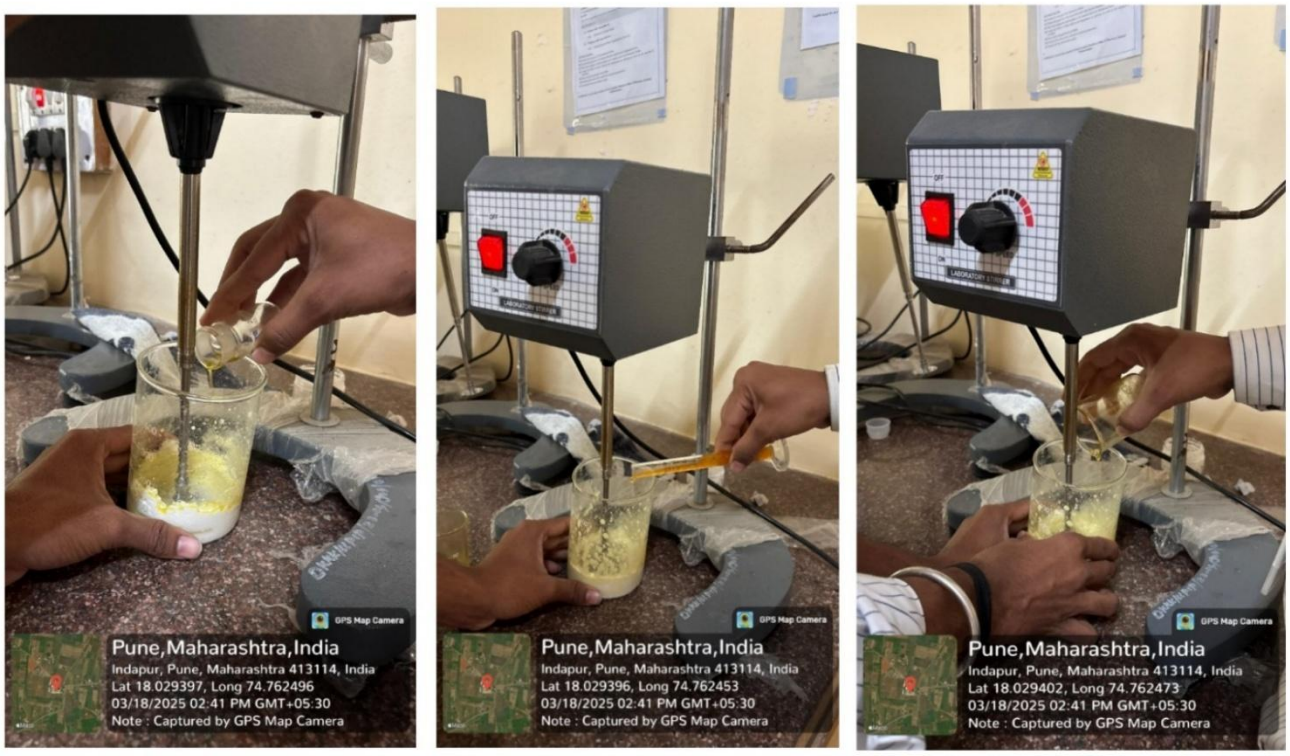
5.3 . Emulsification:

Once both phases reached the target temperature, the aqueous phase was gradually added to the oil phase under constant stirring at 1200 rpm using a magnetic stirrer. This slow and continuous mixing allows the formation of a stable water-in-oil (W/O) emulsion, which is ideal for moisturizing and occlusive cream bases suitable for acne-prone skin. **[36].**

5.4 .Cooling and Addition of Extracts:

After emulsification, the cream base was allowed to cool naturally to 40°C, preventing degradation of heat-sensitive actives. Once cooled, prepared fruit extracts — including papaya, orange peel, green tea, and lemon extracts — were added at specified concentrations (in ml/g). Alongside, Phenoxyethanol (0.5%) was added as a preservative. Stirring was continued until a uniform, homogeneous cream was obtained **[36]**

(**Fig No 15 :** Cooling of mixture of Oil phase and water phase)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(**Fig No 16 :** Mixture of extract on the cream based)

5.6.Filling and Storage:
The final cream was transferred into sterilized, airtight glass containers using a stainless-steel spatula or dispensing unit. The containers were labeled and stored at room temperature (~25°C) away from direct sunlight and humidity. This ensures product integrity and prolongs shelf life for evaluation and future testing. **[35], [36].**

6.Evaluation of Anti-Acne Cream :
The formulated anti-acne cream was evaluated based on physicochemical, microbiological, and clinical parameters. The evaluation aimed to assess the product's safety, stability, performance, and effectiveness.

6.1 Evaluation Parameters and Methods :

Table 4: Evaluation Parameters of Anti-Acne Cream

Parameter	Methodology
pH Measurement	Measured using a digital pH meter. A 1:10 w/v cream-to-distilled water dispersion was used. Desired pH range: 4.5 to 6.5 for skin compatibility **[37]**
Viscosity	Determined using a Brookfield Viscometer at 25°C with Spindle No. 64 at 50 rpm to ensure consistent cream texture **[38]**
Spreadability	Evaluated by glass slide method. 1 g of cream was placed between two glass plates, and 500 g weight applied. Diameter of spread was measured after 5 minutes **[39].**
Stability Studies	Cream was stored at 4°C, 25°C, and 40°C for 4 weeks. Observations for color change, phase separation, odor, and consistency were recorded weekly **[40].**
Microbial Analysis	Performed using nutrient agar plate count method. Total viable count (TVC) and absence of pathogens (E. coli, S. aureus) were confirmed **[41].**
Efficacy Testing	Tested on 10 volunteers with mild to moderate acne. Cream was applied twice daily for 4 weeks. Improvement in acne lesions, reduction in inflammation, and absence of irritation were recorded weekly **[42].**

6.2 Results of Evaluation Tests :
The results of evaluation tests confirmed the effectiveness and stability of the formulated anti-acne cream.

- The pH of the cream was within the acceptable range (5.3–5.8), ensuring suitability for skin application **[37].**
- The cream showed good viscosity (15,000–18,000 cps), indicating stable consistency **[38].**
- Spreadability was uniform, with an average spread diameter of 6.8 cm under the test conditions **[39].**
- The formulation remained physically stable under all three storage conditions with no phase separation or discoloration **[40].**
- Microbial analysis showed total viable count within acceptable limits and no growth of E. coli or Staphylococcus aureus **[41].**
- 80% of volunteers reported reduction in acne lesions with no irritation or side effects over 4 weeks **[42].**

RESULTS AND DISCUSSION

The formulated anti-acne cream enriched with fruit extracts (papaya, orange peel, green tea, and lemon) underwent comprehensive evaluation for physicochemical, microbiological, and therapeutic properties. The results obtained are discussed below:

a. Physicochemical Evaluation :

- pH Measurement: The pH of the cream ranged between 5.3–5.8, which aligns with the skin's natural pH (4.5–6.5), indicating compatibility and reduced risk of irritation.
- Viscosity: The cream exhibited a stable viscosity range of 15,000–18,000 cps, ensuring proper consistency for topical application without phase separation.
- Spreadability: A spread diameter of approximately 6.8 cm was observed under standard testing conditions, suggesting excellent ease of application and uniform skin coverage.

These parameters confirm that the cream possessed desirable rheological properties, making it user-friendly and cosmetically elegant.

b. Stability Studies :

The formulation was stored at 4°C, 25°C, and 40°C over four weeks. No significant changes in color, odor, phase separation, or consistency were noted under any of the storage conditions, confirming its physical and chemical stability. This highlights the robustness of the emulsion system used and the thermal tolerance of the incorporated fruit extracts.

c. Microbial Analysis :

Total viable count (TVC) remained within pharmacopeial limits, and pathogenic organisms such as E. coli and Staphylococcus aureus were absent. This validates the effectiveness of Phenoxyethanol (0.5%) as a preservative and confirms good microbiological safety for topical use.

d. **Efficacy Assessment :**

In a preliminary efficacy test conducted over four weeks on 10 volunteers with mild to moderate acne:

- 80% of participants reported a visible reduction in acne lesions.
- No skin irritation, redness, or adverse reactions were noted in any of the subjects.
- The cream demonstrated noticeable improvements in skin clarity, reduction of inflammation, and prevention of new acne formation.
- The therapeutic success is attributed to the synergistic action of the bioactive phytochemicals:
- Papaya: Enzymatic exfoliation by papain helped remove dead skin and reduce comedones.
- Orange peel and lemon extracts: Provided antioxidant and astringent actions that brightened skin and minimized sebum.
- Green tea: Offered anti-inflammatory and antibacterial protection, reducing swelling and redness.

These results affirm the functional benefits of combining natural fruit-based ingredients in an emulsion system, offering both preventive and curative effects for acne-prone skin.

(Fig No 17 : Final Fruit Extract Based Anti Acne Cream)

CONCLUSION

This study successfully formulated and evaluated a novel anti-acne cream using natural fruit-based extracts in a stable water-in-oil (W/O) emulsion. The product demonstrated ideal physicochemical characteristics, microbial safety, excellent spreadability, and effective acne management without causing skin irritation.

The use of fruit extracts such as papaya, orange peel, green tea, and lemon collectively delivered exfoliating, anti-inflammatory, antibacterial, and antioxidant effects, making the formulation a promising herbal alternative to conventional chemical-based acne treatments.

The encouraging results suggest that the developed formulation could be further optimized and clinically validated on a larger population to establish its market potential. With increasing consumer preference for herbal and natural products, such fruit-based anti-acne creams can play a significant role in safe and sustainable skincare therapies.

REFERENCES

[1]. Bhate, K., & Williams, H. C. (2013). Acne vulgaris. The Lancet, 382(9870), 763-772.
[2]. Zaenglein, A. L. (2018). Acne vulgaris. New England Journal of Medicine, 379(14), 1343-1352.
[3]. Dreno, B. (2017). Topical antibiotic therapy for acne vulgaris: current perspectives and future prospects. American Journal of Clinical Dermatology, 18(5), 647-654.
[4]. Heng, A. H. S., & Chew, F. T. (2020). Systematic review of the epidemiology of acne vulgaris. Scientific Reports, 10(1), 5754.
[5]. Saraf, S. (2010). Applications of novel drug delivery system for herbal formulations. Fitoterapia, 81(7), 680-689.
[6]. Aravind, G., Bhowmik, D., Duraivel, S., & Harish, G. (2013). Traditional and medicinal uses of Carica papaya. Journal of Medicinal Plants Studies, 1(1), 7-15.
[7]. Sharma, N., & Tripathi, A. (2008). Effects of citrus peel extracts on growth of some food-borne fungi. World Journal of Microbiology and Biotechnology, 24(9), 1957-1962.
[8]. Nayak, B. S., & Pereira, L. M. P. (2006). Catharanthus roseus flower extract has wound-healing activity in Sprague Dawley rats. BMC Complementary and Alternative Medicine, 6(1), 41.
[9]. Yoon, J. Y., & Kim, Y. G. (2013). Green tea in dermatology: Green tea polyphenols have anti-inflammatory and antibacterial properties against acne. Journal of the American Academy of Dermatology, 68(4), AB56.
[10]. Rowe, R. C., Sheskey, P. J., & Quinn, M. E. (2009). Handbook of Pharmaceutical Excipients (6th ed.). Pharmaceutical Press.
[11]. Allen, L. V., Popovich, N. G., & Ansel, H. C. (2005). Ansel's Pharmaceutical Dosage Forms and Drug Delivery Systems (8th ed.). Lippincott Williams & Wilkins.
[12]. United States Food and Drug Administration (US FDA). (2020). Non-Comedogenic Ingredients List. Retrieved from https://www.fda.gov/
[13]. Barel, A. O., Paye, M., & Maibach, H. I. (2014). Handbook of Cosmetic Science and Technology (4th ed.). CRC Press.
[14]. Rathore, P., Swami, G., & Yadav, M. (2021). Formulation and Evaluation of Herbal Creams Containing Natural Ingredients. International Journal of Pharmaceutical Sciences and Research, 12(3), 1502–1507.
[15]. Remington, J. P. (2006). Remington: The Science and Practice of Pharmacy (21st ed.). Lippincott Williams & Wilkins.
[16]. Lodén, M., & Maibach, H. I. (2000). Dry Skin and Moisturizers: Chemistry and Function. CRC Press.
[17]. Vogler, B. K., & Ernst, E. (1999). Aloe vera: A systematic review of its clinical effectiveness. British Journal of General Practice, 49(447), 823–828.
[18]. Bhattacharya, S. (2011). Papain in Skin Care. Journal of Cosmetic Dermatology, 10(3), 245–248.
[19]. Aravind, G. et al. (2013). Traditional and Medicinal Uses of Carica papaya. Journal of Medicinal Plants Studies, 1(1), 7-15.
[20]. Chidambara Murthy, K. N. et al. (2001). Citrus Peel Extracts: Antioxidant and Antimicrobial Properties. Food Chemistry, 79(3), 379–384.
[21]. Gupta, A. & Kumar, R. (2016). Orange Peel: A Potential Source for Skin Remedies. Journal of Pharmacognosy and Phytochemistry, 5(4), 192-195.
[22]. Katiyar, S.K. (2003). Green Tea in Skin Photoprotection. Current Drug Targets - Immune, Endocrine & Metabolic Disorders, 3(3), 234–242.
[23]. Yoon, J. et al. (2013). Green Tea Polyphenols in Acne Management. Journal of Dermatological Science, 70(3), 190–196.

[24]. Sharma, R., & Soni, V. (2020). Lemon in Skin Care. International Journal of Herbal Medicine, 8(1), 45–48.
[25]. Ali, M. et al. (2018). Citrus limon: Phytochemistry and Cosmetic Uses. Journal of Natural Remedies, 18(1), 1–9.
[26]. World Health Organization. (2003). WHO Guidelines on Good Agricultural and Collection Practices (GACP) for Medicinal Plants. Geneva: WHO Press.
[27]. Indian Pharmacopoeia Commission. (2018). Indian Pharmacopoeia. Government of India, Ministry of Health and Family Welfare, Ghaziabad.
[28]. Poucher, W. A. (1991). Poucher's Perfumes, Cosmetics and Soaps (10th ed.). Springer.
[29]. Akinyemi, A. J., & Akinmoladun, F. J. (2020). Shea Butter: Nutritional and Therapeutic Applications. Journal of Ethnopharmacology, 261, 113221.
[30]. Bhattacharya, S. (2011). Papain in Skin Care: Natural Enzymatic Exfoliation. Journal of Cosmetic Dermatology, 10(3), 245–248.
[31]. Chidambara Murthy, K. N., Jayaprakasha, G. K., & Patil, B. S. (2001). Antioxidant and Antibacterial Activity of Citrus Peel Extracts. Food Chemistry, 79(3), 379–384.
[32]. Katiyar, S. K. (2003). Skin photoprotection by green tea: Antioxidant and immunomodulatory effects. Current Drug Targets – Immune, Endocrine & Metabolic Disorders, 3(3), 234–242.
[33]. Sharma, R., & Soni, V. (2020). Lemon Juice in Skin Care: A Natural Astringent and Brightening Agent. International Journal of Herbal Medicine, 8(1), 45–48.
[34]. Cosmetic Ingredient Review Expert Panel. (2007). Final Report on the Safety Assessment of Phenoxyethanol. International Journal of Toxicology, 26(Suppl 5), 1–94.
[35]. Allen, L.V. (2004). Remington: The Science and Practice of Pharmacy, 21st ed., Lippincott Williams & Wilkins.
[36]. Lachman, L., Lieberman, H.A., & Kanig, J.L. (1986). The Theory and Practice of Industrial Pharmacy, 3rd ed., Lea & Febiger.
[37]. U.S. Pharmacopeial Convention. (2020). United States Pharmacopeia–National Formulary (USP 43–NF 38).
[38]. Brookfield Engineering Laboratories. (2015). Viscosity Testing of Creams and Lotions Using a Brookfield Viscometer.
[39]. Gupta, G. D., & Gaud, R. S. (2005). Release Rate of Nimesulide from Different Ointment Bases Using Diffusion Cell. Indian Journal of Pharmaceutical Sciences, 67(3), 346–349.
[40]. ICH. (2003). Stability Testing of New Drug Substances and Products Q1A (R2). International Council for Harmonisation.
[41]. World Health Organization. (2009). Guidelines for Assessing the Microbiological Quality of Cosmetic Products. Geneva: WHO Press.
[42]. CDSCO. (2020). Ethical Guidelines for Biomedical Research on Human Participants. Central Drugs Standard Control Organization, Government of India.